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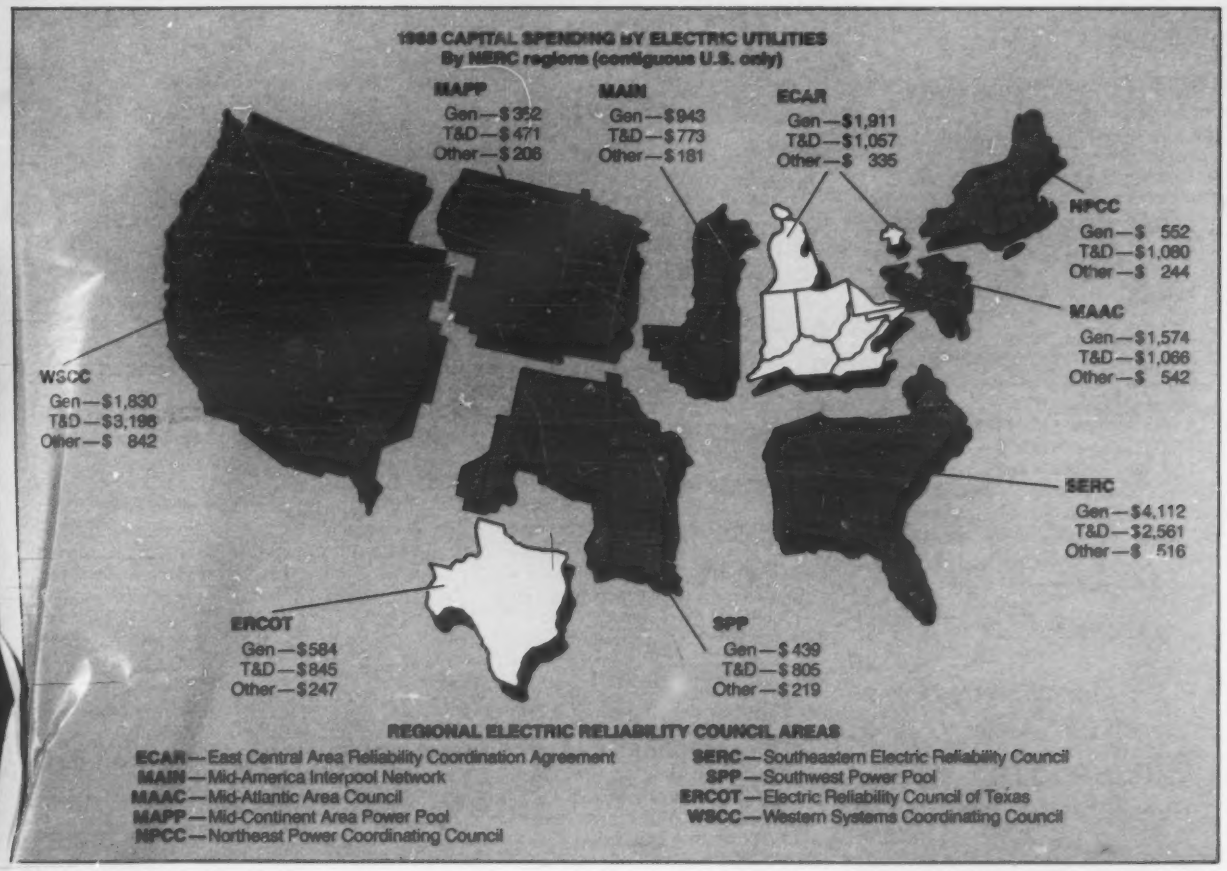
VOICE OF THE ELECTRIC UTILITY INDUSTRY

$27.5-billion of new plant to be built in '88



BARRINGTON, IL—U.S. electric utility organizations will invest almost $27.5-billion for new facilities in 1988. This is one of the findings from EL&P's latest survey of electric utility capital investment plans, which was completed in late November.

This amount reflects an increase of $487-million, or 1.9 percent, from 1988 plans reported a year ago. But the total is 3.9 percent, or $1.1-billion, below last year's capital spending projections.

Projected capital spending for generation facilities in 1988 shows a decline of $751-million, while "Other" spending will fall $813-million.

T&D spending will increase in 1988 to $11.9-billion, from $11.5-billion in 1987. Substation spending, which tends to be understated because many reporting utilities include those programs in transmission and/or distribution plans rather than separately, appears to be about the same as in 1987, while transmission spending is projected to fall by $322-million. But distribution spending will increase by more than $780-million, reflecting the strength of the construction business.

Overall, generation spending will be almost 45 percent of total capital spending in 1988. While total generation spending in 1988 will be down, its share will increase from projections of 1988 spending made a year ago.

See the full capital spending survey report beginning on page 11.

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LATE NEWS

Palo Verde Nuclear Generating Station dedication by DOE Secretary John S. Herrington marked completion of the 3810-MW facility. Unit 3 goes commercial this month. See the related report, page 24.

Nine Vermont utilities and Hydro-Quebec agreed to a 30-year, $2.5-billion contract for up to 500 MW, starting as early as 1990. Utilities would get 30 percent over the next 5 years, a combined-cycle plant.

PS of New Hampshire proposed a [illegible] financial restructuring that would give unsecured debt holders a controlling interest, wipe out a substantial amount of debt, but dilute interests of current common stockholders. A trustee for certain debtholders earlier filed suit seeking to attach property because of PSNH defaults on interest payments. See story this issue.

The Federal Energy Regulatory Commission has the power to allocate the costs of the Grand Gulf 1 nuclear plant among four Middle South utilities that own it, a Supreme Court decision to let stand a federal appeals court ruling says.

SMUD voters would not open plant: Duke Power poll

SACRAMENTO—A Duke Power Co. poll showed that most residents in the Sacramento Muncipal Utility District oppose reopening the troubled Rancho Seco nuclear power plant.

Duke officials have indicated that they may be interested in purchasing or operating the plant as one possible agreement they could strike with SMUD.

Pacific Gas & Electric has proposed buying the entire district for an undisclosed amount, but said it would close Rancho Seco, which represents about half the district's generating power. At SMUD's request, area utilities have quoted prices for supplying long-term replacement power.

Rancho Seco, closed since a 1985 emergency shutdown, is to restart late in January, begin power pro-

Continued on page 6

Three Zimmer utilities settle, write off GE suit

In a complex financial settlement, three utilities expect to take write-offs totalling $220 million after settling a lawsuit against General Electric Co. and Sargent & Lundy Engineers.

The utilities already suffered more than $321 million in related write-offs in 1985.

In the lawsuit, the utilities sought to recover damages from GE for increased costs at the William H. Zimmer generating station because of design and construction modifications in the reactor containment system. Zimmer, located in Moscow, OH, is now being converted from a nuclear plant to a coal-fired plant.

After a summary trial and negotiations, GE agreed to pay $78.3 million to the utilities in return for two unused non-nuclear turbines purchased in 1979 and 1980. The turbines are carried on the utilities' books at $41 million. GE and the utilities will sell other unneeded material and equipment from the site and halve the proceeds

Separately, Sargent & Lundy paid the utilities $27.7 million.

As a result of the settlement:

□ The Cincinnati Gas & Electric Co. expects to take a $91-million write-off after-taxes against 1987 earnings.

That amount is in addition to $142 million that CG&E wrote off in late 1985, resulting from a Ohio Public Utilities Commission ruling which disallowed the inclusion of $861 million ($400 million CG&E's share) of

Continued on page 7

News Briefs

JILL MINNER, Assistant Editor

NRC grants full power license to Palo Verde Unit 3

● The Nuclear Regulatory Commission Office of Nuclear Reactor Regulation has issued a full power operating license to Arizona Public Service Company for Unit 3 of its Palo Verde nuclear generating station. Unit 3, located west of Phoenix, is the third unit licensed of the three-unit station.

Middle South Utilities signs agreement with NAACP

● Middle South Utilities, Inc. (MSU) recently became the first electric holding company in the nation to sign a Fair Share Agreement with The National Association for the Advancement of Colored People (NAACP), the association said. "Middle South Utilities evidenced admirable good faith by approaching the NAACP about signing a Fair Share Agreement, instead of it being the other way around," stated NAACP Executive Director Benjamin L. Hooks. "We have rarely worked with a company that has evidenced such a positive attitude in helping to assure increased economic and employment opportunities for minorities," Hooks added. MSU Chairman and President Edwin Lupberger said, "the company has a number of minority programs in place, and is planning others." MSU's operating subsidiaries—Arkansas Power and Light, Louisiana Power and Light, Mississippi Power and Light, and New Orleans Public Service, Inc.—had previously signed Fair Share Agreements with the NAACP.

NEPOOL, Hydro-Quebec sign short-term power agreement

● The New England Power Pool (NEPOOL) has signed a short-term contract with Hydro-Quebec for the purchase of 500 MW of electricity. NEPOOL Executive Director Phillip C. Otness said the contract will improve New England's power supply during the winter months and will provide additional energy during peak demand periods. Otness added that the agreement, "...is based on Hydro-Quebec's thermal resources which can be delivered to New England even when Quebec is experiencing record winter demand in its own region."

DOE responds to recommendations in NAS/NAE safety report

● The National Academies of Sciences and Engineering have released a report on safety issues at the Department of Energy's (DOE) production reactors, which contains a number of safety recommendations. In response to the recommendations, DOE said its plans include: establishing an external oversight committee for nuclear safety; the Assistant Secretary for Environment, Safety and Health (ES&H) will prepare and coordinate a plan to improve DOE's independent safety oversight function; the Assistant Secretary for FS&H will develop and coordinate a plan for revising the DOE order system and safety standards; DOE will sign a Memorandum of Agreement with the Institute of Nuclear Power Operations; the Assistant Secretary for Defense Programs will prepare an action plan for resolution of each technical recommendation in the NAS report. Energy Secretary John S. Herrington, who requested that the academies prepare the report, said, "The report is impressive and constructive....The challenge now is to get the fullest possible benefit from this report."

Asea Brown Boveri names president, CEO for U.S. operations

● Klaus E. Agthe has been appointed president and chief executive officer of U.S. operations for Asea Brown Boveri. The newly formed company is the result of a merger between Asea AB in Sweden and BBC Brown Boveri in Switzerland. Agthe was formerly president and CEO of BBC Brown Boveri USA.

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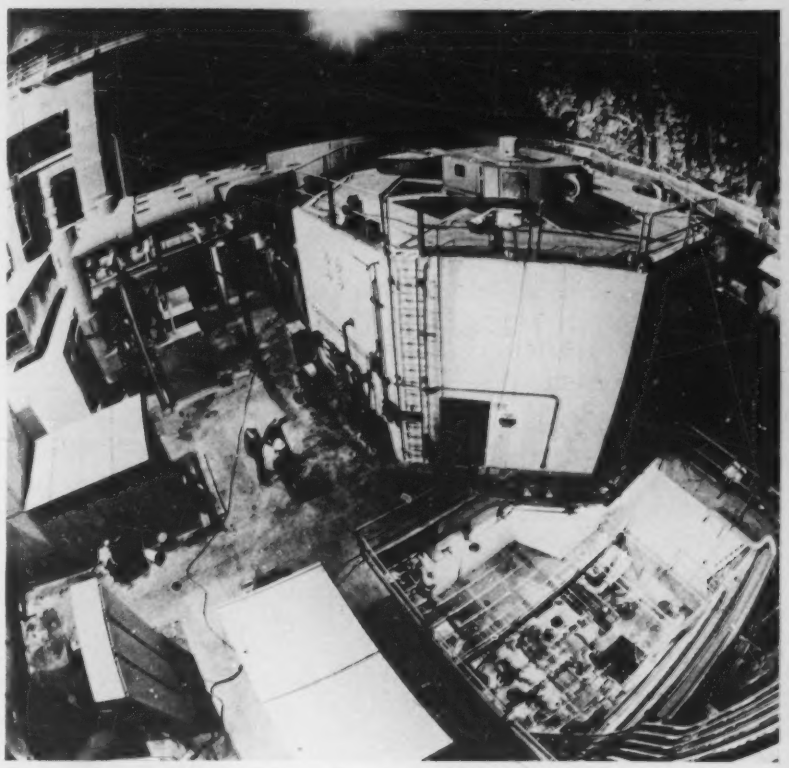
EL&P readers whose responsibilities include both Generation and Transmission/Distribution receive both technology sections. Other readers receive the technology section that applies to their respective area of responsibility. The Generation edition is indicated by a single dot (●) in the upper right corner of page 1; the T/D edition carries two dots (●●). All readers receive EL&P's industry news section.

SoCalEd's Balsam Meadow Hydro Project begins operating



● Southern California Edison Company (SCE) said its Balsam Meadow Hydroelectric Project, located in the John S. Eastwood Power Station, officially went 'on-line' December 1. According to SCE, the 200-MW turbine is anchored in a cavern carved from solid granite 1000 feet below the Sierra Nevada Mountains northeast of Fresno, CA.

Westinghouse finds FFTF useful in fight against osteoporosis

● According to Westinghouse Hanford Company, a radioactive element produced at its Fast Flux Test Facility (FFTF) is now being distributed internationally for use in fighting osteoporosis, a crippling bone disease. The element is used as the irradiation source in an advanced bone-scanning machine which helps doctors detect the onset of osteoporosis and monitor treatment effectiveness, explained Robert Schenter, lead scientist for the company's isotope production program. "This is the first time that FFTF isotopes have been sold for medical purposes, and we plan to continue," Schenter commented. The FFTF, a multipurpose test reactor for advanced nuclear fuels and materials development, is operated by Westinghouse Hanford for the Department of Energy.

PES establishes award to honor outstanding young engineer

● The Power Engineering Society (PES) announced that it has established the Walter Fee Outstanding Young Engineer Award. According to PES, the award is for outstanding contributions in the leadership of technical society activities including local and/or transnational PES and other technical societies; leadership in community and humanitarian activities; and evidence of technical competence through significant engineering achievements. Eligible nominees must be 35 years-old or under on January 1 of the presentation year and have been a member of PES for at least one year. The deadline for nominations is March 15, 1988. For more information contact: Dr. B. Don Russell, Chairman, Walter Fee Outstanding Young Engineer Award Committee, Dept. of Electrical Engineering, Texas A&M University, College Station, TX, 77843-3128 or call (409) 845-1423.

DOE picks firms to develop coal-burning diesel engines

● Two industrial teams have been selected by the Department of Energy to develop an advanced diesel engine for commercial use. DOE said the government-financed project could help return coal to major transportation and industrial power markets. Each of the two teams, headed by Arthur D. Little, Inc. and GE Transportation Systems, has proposed to fund up to 20 percent of its project's cost, according to DOE.

Atlantic Electric thanks customers for helping with campaign

● Atlantic Electric said it has ended the 'Power On' campaign that it began last spring when an oil tanker crashed into a transmission tower, knocking out a 500,000-volt power line. The campaign, designed to ensure reliable electric service during repair of the damage, called for utility customers to curtail energy usage during peak demand periods. "Our message now is a heartfelt thanks to our customers," said Atlantic Electric President and CEO E. Douglas Huggard, "Their cooperation and willingness to observe sound energy use practices this summer—especially on those uncomfortable days, when we made our most urgent appeals for conservation—helped us to avert any serious problems."

Editorial

A look back and a look ahead

The final days of 1987 are winding down as this editorial is being written. Usually this column is devoted to commentary about developments in the industry that can affect you, our readers. But this month I'd like to use this space to discuss developments at *Electric Light & Power*, to take time to stop for a moment, to pause and take stock of where we've been and where we're going.

1987 has been a great year for *EL&P*, and I'd like to share some of the sense of achievement, growth and excitement that we've experienced. I also want to share with you, our readers, an idea of some of the new things we're planning for the year ahead.

We began 1987 by being welcomed into the PennWell Publishing Company family. PennWell, as some of our readers already are aware, publishes *Oil & Gas Journal* and a number of other publications in the high technology and dental fields, and has built a strong reputation for editorial integrity and excellence, and almost immediately we began to sense the different environment. Pressures and limitations that curtailed some activities formerly were lifted. As editors, we've been encouraged to broaden our coverage of industry developments, to seek new ways to serve our readers. The relationship with the PennWell management has strengthened through the year as we have gotten to know each other better. It's been a great experience.

In April we moved to our new quarters at 1250 S. Grove in Barrington, where we share brand-new facilities with our sister publication, *Power Engineering*. The new building is only across the street from our former offices, but it's a world away in terms of working atmosphere.

During the late Spring, Hank Stein joined the *EL&P* editorial team as engineering editor, bringing to the publication a new perspective on technological development and increasing our capacity to serve readers' needs for technical information. Then in the early Fall, we brought Mark Hoske onto the staff to bolster news coverage.

In 1987, we brought you our four regular Special Reports, then added 22 Technology Focus reports that covered technical subjects ranging from fuels and fuel handling to and through the power plant and out to customers' meters, from SCADA system to training to water treatment to instrumentation and controls. This represents the largest output of special *EL&P* editorial materials in more than a decade.

As a result of this broad editorial menu provided during the year and your consistant desire for more, better information about developments in and around the electric utility industry, you again made *EL&P* the best-read of all publication serving the electric utility industry. This readership subsequently was converted to increased advertising sales, producing added revenues to pay for production of the publication. That we finished 1987 ahead in sales of advertising, revenues and earnings, is a direct reflection of your loyalty and readership.

Yes, 1987 was quite a year for me and for the whole staff. But if you liked what you received in 1987, just wait for '88 to unfold. Like Al Jolson used to say, "You ain't seen nothin' yet!"

This issue reflects the first step in our redesign to better reflect the increasing excitement and dynamism of the industry. In March, you will see new formats throughout, with new typefaces that will make *EL&P* even easier to read. We're also adding several new departments to help you stay abreast of industry developments in subject areas we covered only peripherally before. We're adding reporters in several parts of the country to increase coverage and we plan to add to our technical staff to improve the quality of the engineering articles and reports we will bring you.

Of course, we'll still publish our four regular Special Reports—the forecast in this issue, the two Top 100 Electric Utilities reports (June and August) and the November Electric Utility of the Year report—and 14 Technology Focus reports. Several other special features are in the works, too.

1988 promises to be even more exciting, challenging and fulfilling than 1987.

As we look to the New Year, our hope for all of you is that your lives will be as challenging and satisfying as ours. From all of us at *EL&P*...Art, Barry, Bill, Carl, Dave, Dianne, George, Hank, Jean, Jill, Larry, Margaret, Mark, Roberta, Roger and Ted—from the whole publishing, editorial, marketing, circulation and production team—may your 1988 be healthy, happy and rewarding... the very best ever.

Robert A. Lincicome, Editor-in-Chief

Letters

1940's work schedules

This letter concerns your article in the August 1987 edition of *Electric Light & Power*, "1940's schedules don't fit today's plant needs," (p.24). Additional information concerning specific models of integrated five-crew eight-hour schedules and 12-hour slowly rotating schedules for a 40-hour work week would be appreciated.

John M. Smith Director,
Energy Control Center
Alabama Electric Cooperative, Inc.
Andalusia, AL

In response to your letter, and others, we have requested that Dr. Coleman provide several examples of how alternative crew shift-work schedules might look. These will be published in a future issue of EL&P *as soon as possible.*

LTC evaluation methods

Having read your article titled "Evaluation method can ease LTC selections" (October *EL&P*, p. 30), it amazes me that the Editor-in-Chief of a well-respected utility magazine would accept an analysis from a representative of one manufacturer as gospel.

To believe a representative can make an accurate analysis on such a complex issue as the merits of load tap changers, is unbelievable.

H.K. Porter Company, Inc., having used the Siemens, ASEA, Westinghouse and Rhinehousen tap changers have design parameters on these units that indicate that none of these on load oil arcing tap changers will handle 500,000 operation(s) at their maximum current rating.

The following questions should be asked.

1. Can the ASEA tap changer contact life handle 500,000 operation(s) at 600 amps [Emphasis provided]?
2. Did Siemens ever make a TL3 tap changer?
3. Does anyone in the utility industry do a bi-annual inspection on LTCs?

When answers are obtained for the above questions, it will be clearly seen that there were some inaccuracies in the analysis.

H.K. Porter Company, Inc. is requesting a copy of Mr. Jerry Norcia's analysis and are prepared to generate a more accurate analysis if you would print it.

C.N. Pany, General Manager
H.K. Porter Company, Inc.
Electrical Division
Belmont, CA

We found Mr. Norcia's approach provocative, although not altogether unbiased. Moreover, we did not accept the approach as 'gospel, but rather as an interesting attempt to simplify a complex process. We always are open to technical responses and will look forward to Mr. Pany's analysis.

SoCalEd to test GM electric van

ROSEMEAD, CA—Southern California Edison is to receive demonstration models of a General Motors Corp. electric van this month. GM said it will begin production-line manufacturing of the one-ton van by the end of this year.

Clean fuel

"Electricity is a clean fuel and ideally suited for mobile-source pollution control," said Michael Hertel, manager of SCE's environmental affairs division.

"If only five percent of the vehicles in the South Coast air basin were electric, we could reduce daily reactive organic gases (ROG) and oxides of nitrogen (NOx) emissions significantly."

Night recharging

In addition, wide-spread use of electric vehicles would help utilities' sale of off-peak power by recharging primarily at night.

About 10 million vehicles now pollute the area—electric vehicles are considered 98 percent less polluting, SCE cited.

Overnight recharge

The van has a range of 60 miles per battery charge with a top speed of 52 miles per hour. Braking helps charge the battery. The van recharges overnight, but can gain a 30-percent charge in two hours.

"Market research indicates that there are at least 10,000 vans in large fleets in the Los Angeles area today that travel less than 60 miles a day," Hertel claimed.

Chrysler is also planning to produce an electric van within two years with a higher maximum speed and longer range, Hertel added.

Others involved in the project are Electric Power Research Institute, the Electric Vehicle Development Corp., the Department of Energy, Tennessee Valley Authority and other independent reseachers. EPRI and TVA operate a vehicle testing center.

Electric Light & Power

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Electric utilities will increase spending plans through 1992

Generation system investment still continues decline

Robert A. Lincicome
Editor-in-Chief

The nation's electric utility organizations are stepping up capital investment programs for new and improved facilities slightly in the 5-year period ending with 1992. This is a primary conclusion from *EL&P's* 1988 Capital Spending survey, which was completed late last November.

Survey results, which include investor-owned companies, cooperatives and public power organizations, are projected to reflect spending plans for the entire electric utility industry.

Overall, utilities will spend almost $122-billion during the 5-year 1988-1992 period. Generation will continue to be the largest single functional area of activity, but represents a declining minority of total capital spending. Combined transmission and distribution spending will total less than generation spending in 1988, but by 1990 will exceed generation spending. Spending for other catagories of activity remains fairly constant at about 12.5 percent of total spending throughout the period.

The study also indicated that pattern of utility capital spending continues to follow the movement of people and businesses. Largest capital investment will be in the areas of greatest growth, namely the Southeast and far West.

Patterns of spending

Funds devoted to generation, as shown in the table on this page, will decline from 44.7 percent of total capital spending in 1988 to a low of 35.2 percent in 1991, before turning upward to 37.7 percent in 1992. T&D spending will rise from 43.3 percent in 1988 to a high of 51.7 percent in 1991, declining to 50.5 percent in 1992.

Other capital spending, as noted earlier, runs between 11.8 percent and 13.1 percent, averaging about 12.5 percent.

Generation expansion plans

The study showed that the majority of utilities are not planning to add substantial amounts of capacity until the mid-1990s or later. Most capacity to be added prior to the mid-1990s will be small, nominally in the 50- to 100-MW range, which means a new influx of combustion turbines, albeit that some may be used in combined-cycle arrangements with existing steam units.

After 1995, a number of mid-size units, in the 300- to 600-MW range, currently are planned. Only a handful of large units, rated above 600 MW, are slated to be built, mostly near or after the turn of the century.

Life extension no trend

With current capacity reserve levels in some question, and with little new capacity planned for the short-to mid-term, it seemed logical to suppose that there would be considerable interest and action to extending the lives of existing generating units. The survey showed that to be an erroneous assumption.

Overall, about 30 percent of reporting electric utilities say they currently are involved in any life extension work. And about half of the utilities that say they are involved in extending the lives of their generating units report they still are in the study or evaluation stage.

One problem with the responses to the question on life extension may result from terminology. Conversations subsequent to mailout of the survey indicated that some utility executives consider plant upgrading to be separate from life extension. In addition, some life extension work may be covered under "maintenance," and not as a capital project. This confusion could account for the slight decline in life extension programs from a year ago.

As might be expected, the majority of active life extension projects are being conducted east of the Mississippi, where so many older plants are located.

1988 spending raised

For 1988, capital spending for new facilities will total $27.5 billion. Although this represents a $1.1-billion decrease from 1987 capital spending projections made a year ago, it reflects a $487-million increase, or 1.8 percent, from the level for 1988 projected a year ago.

The majority of the decrease from 1987 projections is generation spending, which will be down some $750-million in 1988 from the projected level in 1987. Actual 1987 spending levels won't be available for some time.

Generation spending in 1988 is projected to be $12.3-billion, down 5.8 percent from 1987 estimates.

The bulk of generation spending will be devoted to projects currently in progress and to some short-term small-capacity increases in peaking power capacity.

Spending for power delivery systems—substations, transmission and distribution facilities—will total $11.9-billion. The brightest spot in this area is distribution, which should increase to almost $8-billion from about $7.2-billion in 1987. Spending for substation construction is projected to drop about $20-million from the 1987 level, to $1.37-billion and transmission, at $2.6-billion, will be down about $322-million.

Readers should note that substation spending figures are generally understated because a number of utilities do not segregate substation

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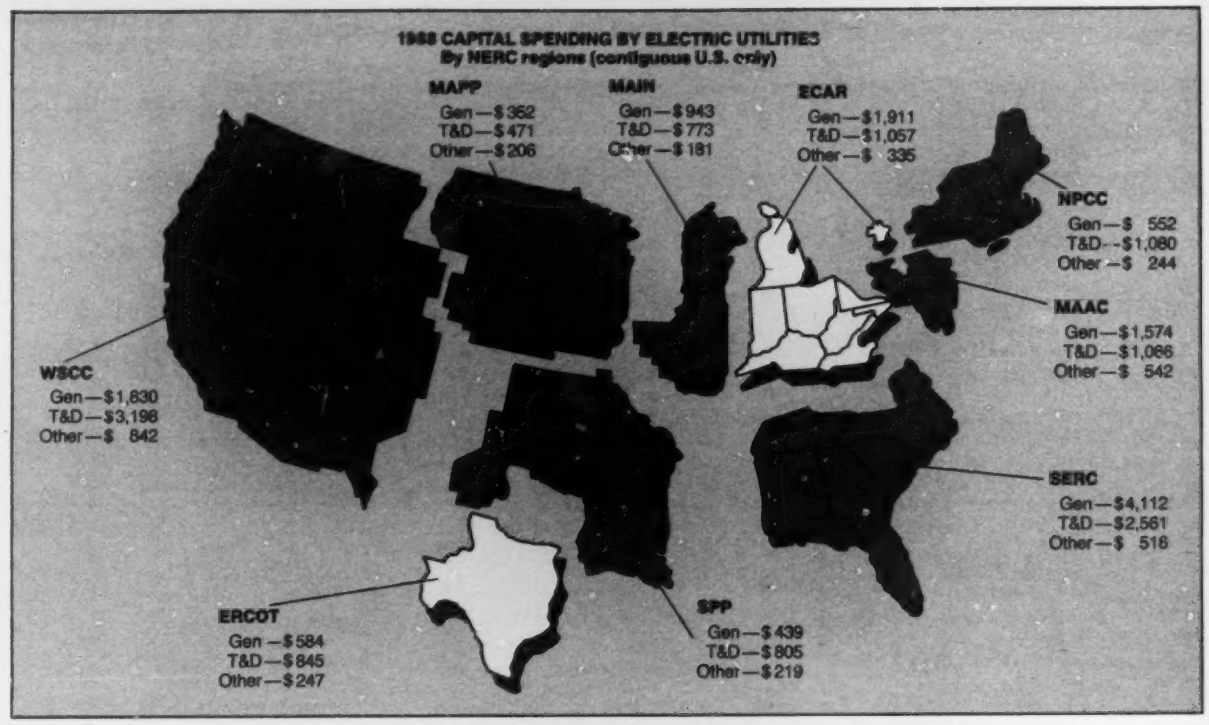


NORTH AMERICAN ELECTRIC RELIABILITY COUNCILS	
ECAR	East Central Area Reliability Coordination Area
ERCOT	Electric Reliability Council of Texas
MAAC	Mid-Atlantic Area Council
MAIN	Mid-America Interpool Network
MAPP	Mid-Continent Area Power Pool
NPCC	Northeast Power Coordinating Council
SERC	Southeastern Electric Reliability Council
SPP	Southwest Power Pool
WSCC	Western Systems Coordinating Council

1988 CAPITAL SPENDING BY NERC REGION
(Contiguous U.S. only—In $ millions)

Region	Generation	Substation	Transmission	Distribution	Other	Total
ECAR	1,911	69	254	734	335	3,303
ERCOT	584	100	309	436	247	1,676
MAAC	1,574	105	168	806	529	3,182
MAIN	943	65	122	587	180	1,897
MAPP	352	33	144	309	191	1,029
NPCC	552	200	153	732	239	1,876
SERC	4,112	231	627	1,708	311	7,189
SPP	438	94	190	524	217	1,463
WSCC	1,830	474	591	2,143	832	5,870
Total	12,296	1,371	2,558	7,979	3,281	27,485

CHANGING PATTERNS OF INVESTMENT
1988-1992

	1988	1989	1990	1991	1992
Generation	44.7%	43.7%	39.2%	35.2%	37.7%
T&D	43.4%	43.7%	47.9%	51.7%	50.5%
Other	11.9%	12.6%	12.9%	13.1%	11.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Spending plans...from page 11

spending, including substation project costs in investment for transmission, distribution or both.

At the same time, projections for transmission and distribution may be overstated by virtue of substation projects lumped into overall T&D investments.

5-year improvement noted

The relative increase in capital investment plans can best be seen by comparing spending plans for the four years common to both the 1987 and 1988 surveys, namely the years 1988-1991.

A year ago, projections of capital investment plans for the period 1988-1991 totalled $96.3-billion. This year's study indicates investment of $99.5-billion for the same period. This represents a net increase in spending of 3.3 percent for the four years, or an average of about $800-million per year.

As expected, the current survey continues to reflect the current overcapacity situation in generation facilities and the reluctance of utility managements to commit to plans for new capacity. This remains true despite the fact that last year's heat storms left a number of utilities near or below safe reserve margin levels, and some utilities actually ended up having to reduce voltages and curtail some load during summer peak demand periods.

At the same time, spending for substations, transmission and distribution facilities remains at a high level, slightly above projections a year ago.

While there continue to be discussions about the need to strengthen both intra- and inter-pool transmission links, there is no apparent strong effort developing during the period. There will be, however, some continuing transmission and substation upgrading efforts in the absence of the need to build new transmission facilities to serve new generating plants.

Other spending

Capital spending in the "Other" category continues at a high level, averaging about $3-billion per year through the 5-year period. A year ago, projections indicated a spending level of 14.5 percent, or $3.7-billion per year. Although the current projection reflects a decrease, "Other" spending still is running substantially above the 4- to 5.5-pecent level that was typical throughout the previous decade.

"Other" capital investment in past years has largely been devoted to headquarters and other office and service buildings, certain capitalized fuel resources and the like. Now, however, spending in this category also includes utility investments in facilities and resources involved in broadened diversification programs.

Projected spending by regions

In the next five years, areas of largest capital investment growth will follow population and business growth trends. For the period, the greatest activity will occur in the SERC area, with the WSCC region slipping. This represents a substantial change from projections made a year ago, reflecting a $9-billion reduction in spending in the West and a $5.6-billion increase in the Southeast.

Figures for regional spending in the following text are expressed in millions of dollars.

ECAR

	Gen	T&D	Other
1988	1,911	1,057	335
1989	1,876	1,022	306
1990	1,358	1,074	324
1991	1,116	1,083	261
1992	761	1,005	256
Total	7,022	5,241	1,482

Utilities in the East Central Reliability Coordination area will spend $13.7-billion for system expansion in the years through 1992. During the period, generation spending will decline steadily, from $1.9-billion in 1988 to $761-million in 1992. Transmission and distribution spending will average around $1.0-billion per year through the period.

About half the utilities in ECAR say they are pursuing life extension programs, but about half of these are still in the study stage.

ECAR utilities plan to add several medium- to large-size generating units (400-1300 MW) in the mid-1990s, but most of the capacity to be added will be units of less than 100 MW.

ERCOT

	Gen	T&D	Other
1988	584	845	247
1989	326	759	179
1990	207	815	186
1991	226	781	177
1992	476	753	273
Total	1,819	3,953	1,042

Texas utilities will spend $6.8-billion for new plant and system in the next five years, with the heaviest investments coming in 1988 and 1992. The survey indicates that generation spending has been slashed from a year ago, with twice as much to be spent for T&D facilities. Generation spending should total something in the range of $1.8-billion, according to survey projections, well below 1986. Power delivery investment will be almost $4.2-billion. Spending in the Other category will hit a 5-year high in 1992, at $273-million.

The majority of utilities report some life extension work, mostly active. This represents an increase in this activity from a year ago.

Little new capacity will be needed before the mid 1990s, mostly in units rated less than 100 MW. As reported a year ago, several larger baseload units will be needed by the latter 1990s.

MAAC

	Gen	T&D	Other
1988	1,574	1,066	542
1989	1,501	953	485
1990	1,349	1,166	497
1991	1,059	1,153	517
1992	849	955	391
Total	6,332	5,293	2,432

Mid-Atlantic Area Council utilities will invest $14-billion for new facilities in the 1988-1992 period. About 44 percent of this capital investment will go for new and upgraded generation facilities, declining steadily from $1.6-billion in 1988 to less than $850-million in 1992. T&D spending for the 5-year period will total $5.3-billion, or about 38 percent. MAAC utilities will need new capacity before 1995. Although some units rated higher than 500 MW currently are planned, the majority of new capacity will be less than 100 MW in size.

The majority of MAAC utilities are involved in some kind of life extension work, although some still is in the analysis and evaluation stage.

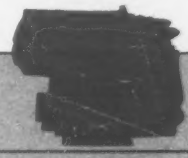
MAIN

	Gen	T&D	Other
1988	943	773	181
1989	584	756	170
1990	457	820	151
1991	386	839	145
1992	273	1,116	114
Total	2,623	4,304	761

Utilities in the Mid-America Interpool Network, comprised of utilities in Illinois, Eastern Wisconsin and Northeastern Missouri, will invest substantially more for transmission and distribution in the next five years ($4.3-billion) than for generation ($2.6-billion). In 1992, MAIN utilities will invest four-times as much on power delivery facilities as on generation.

The MAIN region has a large reserve margin and little new capacity will be needed until the mid-1990s. What capacity that is added largely will be under 100 MW in size, for peaking. After 1995, there is a potential need for several larger units, in the 500-MW range.

About 30 percent of MAIN utilities are involved in some form of life extension study or actual work.



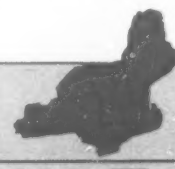
MAPP

	Gen	T&D	Other
1988	352	471	206
1989	476	449	187
1990	406	476	220
1991	404	496	190
1992	297	454	269
Total	1,935	2,346	1,072

The Mid-Continent Area Power Planners pool is the smallest NERC region, electrically. Utilities will invest $5.3-billion in new facilities over the next five years, with T&D spending ($2.3-billion) exceeding generation spending ($1.9-billion) by about $400-million.

About 40 percent of MAPP utilities are involved in some form of generating plant life extension, largely active projects. This represents a substantial increase in life extension activity in the area since last year.

Some new generating capacity will be needed in the late 1990s, largely units rated at 100 MW or less, although there may be several larger units rated 400 MW or more.



NPCC

	Gen	T&D	Other
1988	552	1,080	244
1989	472	985	269
1990	493	1,039	250
1991	531	1,039	230
1992	450	909	159
Total	2,498	5,052	1,152

Utilities in the Northeast Power Coordinating Council are depending on power from Canada to make up for regional capacity deficiencies

PROJECTED 5-YEAR CAPITAL EXPENDITURES
(By NERC Region — In $ millions)

Region	1988	1989	1990	1991	1992	5-Year total
ECAR	$ 3,303	$ 3,204	$ 2,756	$ 2,460	$ 2,022	$ 13,745
ERCOT	1,676	1,264	1,188	1,184	1,502	6,814
MAAC	3,182	2,939	3,012	2,729	2,195	14,057
MAIN	1,897	1,490	1,428	1,370	1,503	7,688
MAPP	1,029	1,112	1,102	1,090	1,020	5,353
NPCC	1,876	1,726	1,782	1,800	1,518	8,702
SERC	7,189	6,766	7,030	6,703	6,224	33,912
SPP	1,463	1,360	1,310	1,389	1,369	6,891
WSCC	5,870	4,784	4,504	4,565	4,886	24,609
Total	$27,485	$24,645	$24,112	$23,290	$22,239	$121,771

PROJECTED 5-YEAR CAPITAL EXPENDITURES
(By Function — In $ millions)

Function	1988	1989	1990	1991	1992	5-Year total
Generation	$ 12,296	$ 10,769	$ 9,443	$ 8,199	$ 8,385	$ 49,092
Substations	1,371	1,384	1,225	1,360	1,175	6,515
Transmission	2,558	2,376	2,397	2,795	3,092	13,218
Distribution	7,979	7,010	7,929	7,882	6,965	37,765
Other	3,281	3,106	3,118	3,054	2,622	15,181
Total	$27,485	$24,645	$24,112	$23,290	$22,239	$121,771

through the 1990s. For this reason, NPCC utilities will spend about twice as much for power delivery facilities ($5.1-billion), including EHV/UHV/DC interconnections with Canadian utilities, as for generating facilities ($2.5-billion). What new capacity that is added will go on line in the latter years of the century and will likely be small modules, rated under 400 MW.

About 20 percent of NPCC utilities are involved in life extension work, although a number say they are thinking about it.

SERC

	Gen	T&D	Other
1988	4,112	2,561	516
1989	3,740	2,425	601
1990	3,767	2,610	653
1991	3,265	2,888	550
1992	3,423	2,249	552
Total	18,307	12,733	2,872

The Southeastern Electric Reliability Council is the largest NERC area for demand and capacity, and it ranks first in terms of capital investment. Growth in utility capital investment mirrors projected economic growth in the area for the next five years. Total investment for facilities will be $33.9-billion, or more than one-fourth of all industry capital investment for the period. To meet demand increases, SERC utilities will invest $18-billion for new generating facilities, with investment running fairly even after 1988. During the period, SERC utilities will invest $12.7-billion for power delivery systems, divided fairly evenly annually throughout the period.

Larger utilities say they will build 300-800 MW units, but most new generating capacity will go in in small increments.

About 25 percent of utilities have active life extension programs.

SPP

	Gen	T&D	Other
1988	439	805	219
1989	387	785	188
1990	343	791	176
1991	375	814	200
1992	415	777	177
Total	1,959	3,972	960

Southwest Power Pool utilities will devote the majority of their capital investment to power delivery facilities in the 1988-1992 period. They will spend almost $4.0-billion for substations and T&D lines, with the spending averaging rather consistently close to $800-million per year. Generation spending dips in the middle three years of the period, but bounces back above the $400-million level in 1992.

Units added will most likely be less than 100 MW in size. These will be added largely between 1993 and 1997. Total spending by SPP utilities is projected at $6.9-billion for the period.

Less than 20 percent of SPP utilities report life extension programs, largely in the study stage.

WSCC

	Gen	T&D	Other
1988	1,830	3,198	842
1989	1,428	2,636	720
1990	1,049	2,775	680
1991	912	2,893	760
1992	1,441	3,014	431
Total	6,660	14,516	3,433

The Western States Coordinating Council is the largest NERC region in geographical area and ranks second in capital investment behind SERC. It remains one of the fastest growing regions of the country. During the next five years, WSCC utilities will invest almost $25-billion in new facilities, spread rather evenly over the last four years of the period after a high of $5.9-billion in 1988. WSCC utilities will invest more than twice as much ($14.5-billion) in power delivery facilities as they will spend for generation improvements ($6.7-billion). Generation spending will hit a low of $900-million in 1991, then rebound in 1992 to $1.4-billion.

WSCC utilities will need new capacity in the latter years of the century, largely in increments of 400 MW or less.

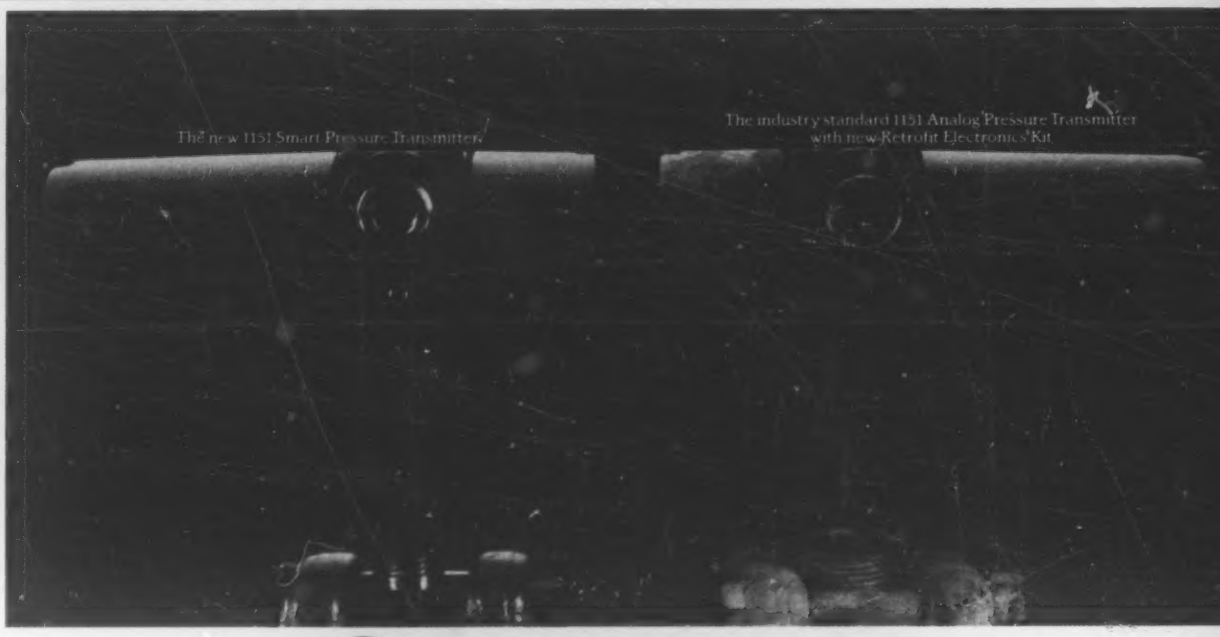
Only 15 percent of WSCC utilities have life extension programs, and less than half are active projects.

Power theft course planned for Feb.

LENOIR CITY, TN—An advanced course about power theft and revenue recovery is scheduled for New Orleans on Feb. 8-10, 1988. The course is designed for utility emplyees who have attended basic power-theft courses or who have experience in the field.

The presenter, Corporate Consultants, has been giving such courses for almost 10 years. Topics to be covered include organized crime investigations, crime scene photography, interviewing techniques, and software applications.

For more information, contact Corporate Consultants at 615/986-8026.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For more information on the 1151, other products in the pressure group, and Rosemount's SMART FAMILY of products, call Phil Hinke at 612-828-3460 or your local Rosemount sales rep. They'll be happy to match you up with the pressure transmitter that best fits your needs.

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Inquire R.S. 6

Generation Update

Palo Verde staffing restructured and downsized

PHOENIX, AZ—Management and organization of the three-unit Palo Verde Nuclear Generating Station have been completely revised and downsized in what may be the industry's first successful large-scale restructuring of a nuclear power plant not beset with problems.

Goal of the program, according to Arizona Public Service Co. President Mark De Michele, is to enhance the safe operation of all three Palo Verde units, as well as reduce the cost of power.

To accomplish this, the number of management levels has been reduced, specifically between De Michele's office and first-line managers, which has improved communications and action response time.

In addition, management positions were slashed by almost 18 percent and the number of contract personnel is being reduced.

Total annual savings are projected at about $40-million.

Voluntary effort

The restructuring, which was not precipitated by actions or criticisms from either the NRC or state regulators, culminated from a study initiated by De Michele and was a proactive effort to downsize the Palo Verde organization consistent with the transition from construction to operation. Unit 3, newest of the three reactors, is expected to be in commercial operation next month, prior to the first refueling outage of Unit 2 in the Spring. Unit 1 entered its first refueling outage last October.

New organization

The Palo Verde facility is comprised of three physically separate units, sharing virtually no common systems. Each of these now is under the responsibility of a separate plant manager. A separate Nuclear Production Support organization provides operational and logistical support to all three units and a Standards and Technical Support group provides engineering and technical backup.

Safety and licensing functions were combined and elevated in the new organization. Operational functions also were elevated and management personnel with operating experience were reassigned to key operating roles.

The new organization was favorably received by the NRC, which formally approved the revised Technical Specifications describing the organization.

Benefits

The new Palo Verde organization provides a strong balance of workloads and responsibilities for top nuclear executives. Other benefits include:

- The maximum number of management levels was reduced from seven to five. Shortened chains of command tend to enhance communications and reduce action response times. Jerry Haynes, nuclear production vice president, told the NRC commissioners at the full-power hearings for Palo Verde, that "the new organizational structure has improved communications flow significantly in both directions."
- The number of management positions (supervisor and above) was reduced by 39, or 17.8 percent, to a total of 180.
- A plan to phase out approximately 800 contract personnel has been initiated.

APS expects to achieve increased productivity at Palo Verde with less management through the use of better-defined "missions" for each organization. By eliminating the overlaps of management levels, quicker response time is anticipated. Disputes and jurisdictional or "turf" battles over responsibilities will be minimized, which means that fewer management personnel will be involved in review and coordination roles. The aim is toward single-point responsibility, so that personnel at all levels will receive clear directions and understand their respective responsibilities.

The staffing level of certain departments was reduced over 50 percent. Some departments were eliminated in total, with their functions being assumed by some other group. Other departments were maintained at their existing staffing levels, or even increased slightly.

By comparison, across-the-board uniform reductions would have severely penalized those organizations that already were operating most efficiently.

Assessment of the Palo Verde organization was initiated during 1986

Continued on page 28

$48 billion of electricity produced in U.S. during 1986

WASHINGTON—Total variable costs of electricity produced in the United States by central-station steam-electric plants in 1986 were more than $48 billion, according to the Utility Data Institute. Its annual production-cost report shows data for 389 coal-fired plants, 135 gas-fired plants, 74 oil-fired, 61 nuclear, and eight other types.

Together, these 667 facilities generated 2.1-billion net megawatts in 1986, which represented 98 percent of all steam-electric generation in the U.S. for the year.

Cost rankings

Nuclear plants, as a group, were the lowest cost, producing 19 percent of that total U.S. electricity at an average variable cost of $19.05 per net megawatthour. Net rates for the other fuels were coal at $21.64/MWh, gas at $30.43/MWh, oil at $33.99/MWh, and others at $33.35/MWh.

In terms of least-expensive electricity, the top 20 included 11 nuclear plants, eight coal-fired, and one gas-fired. Interestingly, the top of the top 20 was the gas-fired plant, Rio Pecos of West Texas Utilities, at $5.42 per net MWh. This top position has "belonged" to the Rio Pecos plant since 1981. Second was the embattled Maine Yankee nuclear plant at $6.67/MWh. (See the related story in last issue about the Maine Yankee facility.)

UDI's report is slightly different from *Electric Light & Power*'s annual list (see the August issue). UDI considers total plant or station heat rate, while *EL&P* lists individual unit heat rates.

Heat rate rankings

The rankings of average plant heat rates (Btu per kilowatthour generated) includes only fossil plants because of inconsistencies in the way nuclear data are reported.

The top five with the most-efficient heat rates in 1986 included two combined-cycle and three coal-fired plants. First in the rankings was Public Service of Oklahoma's Comanche combined-cycle plant at a heat rate of 8821. Second was TVA's Bull Run coal-fired plant at 8870. Third through fifth were: Massachusetts Municipal Wholesale Electric's Stonybrook combined-cycle facility; and Duke Power's coal plants at Belew's Creek and its Marshall station.

Size rankings

In terms of the most electricity generated last year, Georgia Power's 3499-MW, coal-fired, Bowen station ranked first, with more than 21-million MWh (net). This was followed by Houston Lighting & Power's Parish coal-fired plant at 17.2-

Continued on page 28

TOP 20 U.S. STEAM-ELECTRIC PLANTS IN 1986 RANKED BY BTU PER KILOWATTHOUR

No.	Plant/Unit	Heat Rate (Btu/kWh)	Operator	Primary Fuel Type	1986 Installed Capacity	1986 Net Generation (MWh)
1	Comanche (OK)	8821	Public Service Oklahoma	CCYC	290	833,366
2	Bull Run	8870	Tennessee Valley Auth	COAL	950	6,346,163
3	Stonybrook	8871	Mass Muni Whsl Elec	CCYC	358	502,217
4	Belews Creek	9005	Duke Power	COAL	2160	14,200,705
5	Marshall (NC)	9060	Duke Power	COAL	1996	9,552,389
6	JH Campbell	9252	Consumers Power	COAL	1420	9,236,950
7	Morgantown	9265	Potomac Electric Power	COAL	1252	6,844,141
8	Crystal River 4&5	9293	Florida Power	COAL	1479	9,328,849
9	Mountaineer	9297	Appalachian Power	COAL	1300	8,999,569
10	Gallatin	9340	Tennessee Valley Auth	COAL	1255	6,637,072
11	Amos	9376	Appalachian Power	COAL	2933	14,612,220
12	Cross 2	9399	South Carolina Pub Serv	COAL	556	2,739,605
13	Mount Tom	9421	Holyoke Water Power	COAL	136	1,078,095
14	New Boston	9435	Boston Edison	OIL	718	4,312,238
15	Bay Shore	9436	Toledo Edison	COAL	639	3,932,403
16	Milliken	9469	New York State Elec & Gas	COAL	316	1,390,679
17	New Haven Harbor	9479	United Illuminating	OIL	480	2,421,501
18	Putnam	9500	Florida Power & Light	CCYC	580	2,253,544
19	McMeekin	9507	South Carolina Elec & Gas	COAL	294	1,468,733
20	Somerset 1	9516	New York State Elec & Gas	COAL	655	4,535,798

Source: "1986 Production Costs, Operating Steam Electric Power Plants," Utility Data Institute.

TOP 20 U.S. STEAM-ELECTRIC PLANTS IN 1986 RANKED BY AVERAGE EXPENSES (INCL. FUEL) PER NET MEGAWATTHOUR

No.	Plant/Unit	Average Expenses/ Net MWH	Operator	Primary Fuel Type	1986 Installed Capacity	1986 Net Generation (MWh)
1	Rio Pecos	5.42	West Texas Utilities	GAS	142	917,560
2	Maine Yankee	9.67	Maine Yankee Atomic Power	UR	864	6,241,756
3	North Anna	10.77	Virginia Elec & Power	UR	1959	12,332,789
4	Laramie River	10.86	Basin Electric Power	COAL	1710	9,215,540
5	Hayden	10.99	Colorado-Ute Elec	COAL	465	2,962,461
6	Point Beach	11.69	Wisconsin Elec Power	UR	1048	7,185,182
7	Calvert Cliffs	11.71	Baltimore Gas & Elec	UR	1829	12,827,653
8	Zion	11.94	Commonwealth Edison	UR	2196	12,239,103
9	Callaway 1	12.06	Union Electric	UR	1236	7,170,229
10	Prairie Island	12.14	Northern States Power	UR	1186	7,679,663
11	Antelope Valley	12.45	Basin Electric Power	COAL	870	4,319,459
12	St. Lucie	12.88	Florida Power & Light	UR	1700	13,180,343
13	Trojan	12.91	Portland General Elec	UR	1216	7,090,231
14	Nine Mile Point	12.96	Niagara Mohawk Power	UR	842	3,146,883
15	Iatan	13.02	Kansas City Power & Light	COAL	726	3,969,421
16	Monticello (TX)	13.09	Texas Utilities Elec	COAL	1980	13,270,109
17	Coal Creek	13.45	Cooperative Power	COAL	1100	6,220,312
18	Clifty Creek	13.58	Indiana-Kentucky Elec	COAL	1304	9,733,628
19	Kewaunee	13.77	Wisconsin Public Service	UR	535	3,854,674
20	JS Cooper	14.10	East Kentucky Power	COAL	321	1,772,335

Source: "1986 Production Costs, Operating Steam Electric Power Plants," Utility Data Institute.

Palo Verde staffing...from page 24

with the formation of a team of in-house managers to look for ways to better align the utility and nuclear facility organizations. There was an initial concern that the nuclear facility was forming a corporate culture and organization separate from that of the utility. Duplicated efforts were found that left no clear accountability for certain areas, said Edwin E. Van Brunt, executive vice president of Arizona Nuclear Power Project, the official corporate designation of Palo Verde. The task force recommended a careful review of the nuclear plant organizations.

Based on the task force recommendations, a consulting firm specializing in the nuclear power industry—DHL Associates, Inc.—was contracted to review organization, staffing and work procedures at Palo Verde. DHL was selected because of prior experience with the organization and staffing of a two-unit nuclear plant in the East and because its nine consultants brought a breadth, as well as depth, of experience totalling more than 150 years of nuclear experience.

Each department at Palo Verde was assigned to a DHL team-member with expertise in that particular area. The consultants interviewed more than 50 Palo Verde managers and senior management officials in structured interviews, seeking information and perceptions of organizational strengths, weaknesses and staffing levels. The interviewers also sought ideas for enhancing Palo Verde's performance.

Following completion of the interviews, DHL personnel conducted an in-depth review of the data obtained, identifying redundancies and overlaps in work performance. Staffing levels were compared with those observed at other nuclear plants. Follow-up questions and observations of work flow were initiated in areas where the scope of the work being done appeared inconsistent with the resources used.

Detailed investigations were performed in the following areas:

- Engineering work authorization processes
- Work order process and the control of maintenance
- Procedures for surveillance tests and preventive maintenance
- Records management systems, including microfilming, configuration control and document distribution.

This data then was combined with suggestions from Palo Verde management and was used to develop preliminary recommendations of functions that should be consolidated and appropriate staffing levels for each department.

In mid-May, 1987, the DHL team met in Phoenix for a peer review of the preliminary recommendations. This approach was suggested by Victor Gilinsky, former NRC commissioner and now a DHL task-force member, who said "If we can't convince each other that our recommendations are valid, then we should not be making these recommendations to the client."

The peer review solidified many preliminary recommendations that were aggregated into an overall organizational structure for Palo Verde. The DHL recommendations then were sent to APS for review and action.

By mid-June, the recommendations had been reviewed by APS executives, both nuclear and non-nuclear, and needed modifications were incorporated. This was followed by the selection of personnel for director-level positions. Concurrently, discussions were commenced with NRC officials. Proposed modifications to the Technical Specifications (Section 6) were filed during the first week of August and approved in October. In the interim, supervisory positions and detailed staffing plans were established for both the utility and for contractors.

Seismic consulting services offered

WALNUT CREEK, CA—Specialized seismic and structural engineering services now are being offered to nuclear utilities by Impell Corp. A new business unit has been formed to provide these services and will concentrate its efforts on the critical seismic issues currently being studied by utility groups and the Nuclear Regulatory Commission.

Specific areas of effort include seismic margin reviews, seismic fragility, development of seismic criteria and probabilistic assessment for nuclear plants.

Dr. Donald A. Wesley, with 21 years of earthquake engineering experience, much of it related to nuclear safety, will head the unit. The unit will be headquartered in Santa Ana, CA.

Electricity...
from page 24

million MWh. The next three in the top five were: Duke Power's Parish coal-fired facility (17.2-million MWh) and its Oconee nuclear plant (16.6); and Public Service of Indiana's Gibson coal unit (16.4).

In addition to the three performance rankings, the report includes variable production costs, with and without fuel, for each of the 667 plants listed.

The complete report, "1986 Production Costs: Operating Steam Electric Plants", is available from: Utility Data Institute Inc., 1700 K St., NW, Suite 400, Washington, DC 20006, for $120 (utilities) or $150 (nonutilities).